

Original Paper

Race, Ethnicity, Socioeconomic Status, and Chronic Lung Disease in the U.S.

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Abstract

Background: Higher socioeconomic status (SES) indicators such as educational attainment and income reduce the risk of chronic lung diseases (CLDs) such as Chronic Obstructive Pulmonary Disease (COPD), emphysema, chronic bronchitis, and asthma. Marginalization-related Diminished Returns (MDRs) refer to smaller health benefits of high SES for marginalized populations such as racial and ethnic minorities compared to the socially privileged groups such as non-Hispanic Whites. It is still unknown, however, if MDRs also apply to the effects of education and income on CLDs.

Purpose: Using a nationally representative sample, the current study explored racial and ethnic variation in the associations between educational attainment and income and CLDs among American adults.

Methods: In this study, we analyzed data ($n = 25,659$) from a nationally representative survey of American adults in 2013 and 2014. Wave one of the Population Assessment of Tobacco and Health (PATH)-Adult study was used. The independent variables were educational attainment (less than high school = 1, high school graduate = 2, and college graduate = 3) and income (living out of poverty = 1, living in poverty = 0). The dependent variable was any CLDs (i.e., COPD, emphysema, chronic bronchitis, and asthma). Age, gender, employment, and region were the covariates. Race and ethnicity were the moderators. Logistic regressions were fitted to analyze the data.

Results: Individuals with higher educational attainment and those with higher income (who lived out of poverty) had lower odds of CLDs. Race and ethnicity showed statistically significant interactions with

educational attainment and income, suggesting that the protective effects of high education and income on reducing odds of CLDs were smaller for Blacks and Hispanics than for non-Hispanic Whites.

Conclusions: *Education and income better reduce the risk of CLDs among Whites than Hispanics and Blacks. That means we should expect disproportionately higher than expected risk of CLDs in Hispanics and Blacks with high SES. Future research should test if high levels of environmental risk factors contribute to the high risk of CLDs in high income and highly educated Black and Hispanic Americans. Policy makers should not reduce health inequalities to SES gaps because disparities sustain across SES levels, with high SES Blacks and Hispanics remaining at risk of health problems.*

Keywords

socioeconomic position, socioeconomic status, educational attainment, income, poverty, ethnicity, race, ethnic groups, African Americans, Blacks

1. Introduction

Although the health effects of socioeconomic status (SES) is well established (Mirowsky & Ross, 2015; Ross & Mirowsky, 1999; Marmot & Bell, 2009; Marmot, 2001, 2005), such effects are unequal across racial and ethnic groups (Assari, 2018, 2017; Hudson, Bullard, Neighbors, Geronimus, Yang, & Jackson, 2012; Hudson, Neighbors, Geronimus, & Jackson, 2012; Farmer & Ferraro, 2005). While high educational attainment and high income predict better health (Marmot & Bell, 2009; Marmot, 2001), recent research has documented weaker protective effects of SES indicators for racial and ethnic minority groups (Montez, Hummer, & Hayward, 2012; Montez, Hummer, Hayward, Woo, & Rogers, 2011; Zajacova & Johnson-Lawrence, 2016; Zajacova & Lawrence, 2018). Marginalization-related Diminished Returns (MDRs) refer to significantly weaker health effects of SES indicators, particularly educational attainment and income, for the socially marginalized people (e.g., racial and ethnic minorities particularly Blacks and Hispanics), relative to the socially privileged individuals (e.g., non-Hispanic Whites) (Assari, 2018, 2017). The MDRs framework can be viewed as a paradigm shift as it investigates the mechanisms behind poor health of racial and ethnic minority people across the full SES spectrum (Assari, 2018, 2017).

Considerable MDRs (Assari, 2018, 2017), are shown in Blacks and Hispanics compared to Whites, documenting weaker effects of SES on health of racial and ethnic groups (Assari, 2018, 2017). Such MDRs are shown for a wide range of SES indicators such as education (Assari, Farokhnia, & Mistry, 2019; Assari, 2019; Assari & Bazargan, 2019; Assari & Mistry, 2018) and income (Assari & Caldwell, 2019; Assari, 2018; Assari, Caldwell, & Mincy, 2018; Assari, 2018) on various health outcomes. Supporting evidence has documented MDRs for drinking (Assari, Farokhnia, & Mistry, 2019), smoking (Assari & Mistry, 2018), diet (Assari & Lankarani, 2018), exercise (Assari, 2019), depression (Assari, 2018), anxiety (Assari, Caldwell, & Zimmerman, 2008), suicide (Assari, Schatten, Arias, Miller, Camargo, & Boudreaux, 2019), obesity (Assari, 2018; Assari, Thomas, Caldwell, & Mincy, 2018), chronic disease (CD) (Assari & Caldwell, 2019; Assari & Moghani Lankarani, 2018; Assari, Caldwell, &

Bazargan, 2019), disability (Assari & Bazargan, 2019), hospitalization (Assari & Bazargan, 2019), and mortality (Assari & Lankarani, 2016) for Black compare to White individuals.

In a study, highly educated Blacks and Hispanics were found to be exposed to high levels of second-hand smoke exposure (Assari & Bazargan, 2019). In another study, highly educated and high-income Blacks and Hispanics were more likely to drink alcohol (Assari, Farokhnia, & Mistry, 2019; Assari & Lankarani, 2016), smoke cigarette (Assari & Mistry, 2018; Shervin & Ritesh, 2019), and vape e-cigarette (Assari, Mistry, & Bazargan, 2020). This is probably why highly educated and high-income Blacks and Hispanics may be at higher risk of chronic obstructive pulmonary disease (COPD) (Assari, Caldwell, & Bazargan, 2019) and asthma (Assari & Moghani Lankarani, 2018), compared to highly educated non-Hispanic Whites. Increased risk of chronic lung diseases (CLDs) may be particularly important and explain high risk of disability (Assari & Bazargan, 2019), hospitalization (Assari & Bazargan, 2019), and mortality (Assari & Lankarani, 2016) in middle-class Black individuals.

Some of the mechanisms behind these MDRs include societal and structural factors such as residential segregation, extra costs of upward social mobility (Assari, Lankarani, & Caldwell, 2018; Assari, 2018), and higher level of exposure (Hudson, Bullard, Neighbors, Geronimus, Yang, & Jackson, 2012; Hudson, Puterman, Bibbins-Domingo, Matthews, & Adler, 2013; Hudson, Neighbors, Geronimus, & Jackson, 2016) and sensitivity to discrimination (Assari, Preiser, Lankarani, & Caldwell, 2018) in high SES Blacks. Given the social stratification, SES is followed with less tangible health outcomes for Black than White people. However, less is known regarding the relevance of MDRs to the effects of educational attainment on CLDs.

As a result of MDRs (Assari, 2018, 2017), the health effects of SES indicators such as educational attainment and income are diminished for racial and ethnic minority groups. Thus, diverse race/ethnic groups not only vary in their SES (Navarro, 1991, 1990, 1989) but also how their SES turns to health outcomes (Assari, 2018; Assari, Preiser, & Kelly, 2018). As a result, it is “race/ethnicity and SES” not “race/ethnicity or SES” that generates racial and ethnic health disparities (Navarro, 1991, 1990, 1989)

Although high education and income reduces exposure to risk factors overall (Lunau, Siegrist, Dragano, & Wahrendorf, 2015; Hackman, Gallop, Evans, & Farah, 2015), Blacks and Hispanics with high education and income report high level of environmental risk factors such as stress (Assari, 2018), discrimination (Assari, Lankarani, & Caldwell, 2018), and active and passive exposure to tobacco smoke (Assari & Mistry, 2018; Assari & Bazargan, 2009; Assari, Mistry, & Bazargan, 2020). That is, the very same SES indicators, such as educational attainment and income, show stronger impact on lowering Whites’ than Blacks’ and Hispanics’ environmental risk exposures, highly educated Blacks and Hispanics are still at risk of hypertension (Assari, 2019), attention-deficit hyperactivity disorder (ADHD) (Assari & Caldwell, 2019), asthma (Assari & Moghani Lankarani, 2018), and COPD (Assari, Caldwell, & Bazargan, 2019).

1.1 Aims

To test whether MDRs also apply to racial and ethnic disparities in CLDs, we compared Blacks, Hispanics, and non-Hispanic Whites for the effects of educational attainment and income on CLDs. While research has well-documented the effects of race/ethnicity (Assari & Moghani Lankarani, 2018; Kamil, Pinzon, & Foreman, 2013) and SES (educational attainment and income) (Assari & Moghani Lankarani, 2018; Kanervisto, Vasankari, Laitinen, Heliövaara, Jousilahti, & Saarelainen, 2011; Kim et al., 2017) on CLDs, very few studies have ever tested MDRs of SES resources on CLDs (Assari & Moghani Lankarani, 2018; Assari, Caldwell, & Bazargan, 2019). This study goes beyond the additive effects of race/ethnicity and SES and investigates multiplicative effects of SES and race/ethnicity on CLDs (Assari & Moghani Lankarani, 2018; Assari, Caldwell, & Bazargan, 2019). This work is in line with the research question if it is race/ethnicity *and* SES or race/ethnicity *or* SES that cause health disparities. To generate generalizable results, we borrowed data from the Population Assessment of Tobacco and Health (PATH) study, a survey with a nationally representative sample of adults (18+ years old). In line with the MDRs (Assari, 2018, 2017) and in line with previous relevant studies (Assari & Moghani Lankarani, 2018; Assari, Caldwell, & Bazargan, 2019), we hypothesized smaller effects of SES (i.e., educational attainment and income) on CLDs for Blacks and Hispanics than non-Hispanic Whites.

2. Methods

2.1 Design and Setting

This cross-sectional study borrowed data from the PATH-Wave 1 study (Chang et al., 2019; Hyland et al., 2017; Tourangeau, Yan, Sun, Hyland, & Stanton, 2018; Harlow, Stokes, & Brooks, 2018), a national survey of American adults sponsored by the U.S. Food and Drug Administration (FDA) and National Institutes of Health (NIH). PATH is a landmark longitudinal study of tobacco use and associated diseases. The PATH study Wave 1 data collection began on 12 September 2013 and ended on 14 December 2014. The PATH design, sampling, sample design, and measures are described elsewhere (Chang et al., 2019; Hyland et al., 2017; Tourangeau, Yan, Sun, Hyland, & Stanton, 2018; Harlow, Stokes, & Brooks, 2018). The PATH sample is limited to the civilian non-institutionalized adult residents of the United States. The PATH study original sample design follows a multistage probability sample that recruited a representative sample of households and non-institutional people. The PATH study has used a multi-stage sampling strategy that involves survey weights. The results of the PATH are generalizable to the U.S. population. In this study, 25659 adults were analyzed. The PATH data is a longitudinal collection, however, we only used baseline data (wave 1).

2.2 Ethics

The original protocol of the PATH study was approved by the Westat Institutional Review Board (IRB). All participating individuals signed an informed written consent. All the PATH data were collected, stored, and analyzed anonymously.

2.3 Measures

2.3.1 Independent Variable

Educational Attainment. Educational attainment was operationalized as a categorical variable with three levels: less than high school graduate, completed high school, some college, and college graduates.

Income Level. (Poverty Status). Poverty status was a dichotomous variable 0) below 100% federal poverty line, 1) above 100% federal poverty line. Thus, a score of 1 reflected higher income and 0 reflected low income.

2.3.2 Moderator

Race. All participants self-identified their race. Race was treated as a dichotomous variable in the current study [Blacks = 1, Whites = 0].

Ethnicity. All participants self-identified their ethnicity. Ethnicity was a categorical variable [Hispanics = 1, Non-Hispanics = 0].

2.3.3 Covariates

Covariates in the current study included age, gender, region, and employment status. Age was a categorical measure with the following levels: 1) “18 to 24 years old”, 2) “25 to 34 years old”, 3) “35 to 44 years old”, 4) “45 to 54 years old”, 5) “55 to 64 years old”, 6) “65 to 74 years old”, and 7) “75 years old or older”. Gender was a dichotomous measure (male =1, female = 0). Region was a categorical variable with the following four levels: (1) Northeast [reference category], (2) Midwest, (3) South, and (4) West.

2.3.4 Outcome

Chronic Lung Diseases (CLDs). CLDs included COPD, chronic bronchitis, asthma, and emphysema. Four items were used to measure the lifetime history of COPD, chronic bronchitis, asthma, and emphysema. For example, participants were asked, “Have you ever been told by a doctor or other health professional that you had asthma”? We operationalized CLDs as a dichotomous variable.

2.3.5 Data Analysis

We used survey mode of the SPSS 23.0 (IBM Inc, NY, USA) for data analysis. We re-calculated the standard errors (SEs) thus the statistics addressed the complex design of the PATH sample. Thus, our estimates and inferences are generalizable to the U.S. sample. We ran logistic regression models without and with interaction terms, all in the pooled sample. *Model 1* only had the main effects of race, ethnicity, educational attainment, income, and covariates. *Model 2* also added the following interaction terms: race \times educational attainment, ethnicity \times educational attainment, race \times income (poverty status), and ethnicity \times income (poverty status). In all models, educational attainment and income (poverty level) were the independent variables (IVs), any CLDs was the dependent variable (DV), while age, gender, region, and employment were covariates. Race and ethnicity were the moderators.

4. Results

4.1 Descriptive Statistics

This study included 25,659 American adults who were either White (82.9%) or Black (17.1%). The sample was either Non-Hispanic (83.9%) or Hispanic (16.1%). Table 1 shows descriptive statistics of the overall sample (Table 1). Participants were almost half men and women.

Table 1. Descriptive Statistics in the Overall Sample

	N	%
Race		
White	21265	82.9
Black	4394	17.1
Ethnicity		
Non-Hispanic	21520	83.9
Hispanic	4139	16.1
Gender		
Women	12705	49.5
Men	12954	50.5
Country Region		
Northeast	3891	15.2
Midwest	6347	24.7
South	9901	38.6
West	5520	21.5
Age		
18 - 24	6877	26.8
25 - 34	5197	20.3
35 - 44	4066	15.8
45 - 54	3979	15.5
55 - 64	3190	12.4
65 - 74	1636	6.4
75+ years old	714	2.8
Educational attainment		
Less than high school graduate	4973	19.4
High school graduate	15137	59.0
College Graduate	5549	21.6
Income Level (Poverty Status)		
Living in poverty	8488	33.1

Living out of poverty	17171	66.9
Employment (Full)		
Unemployed	13589	53.0
Employed	12070	47.0
CLDs		
No	21376	83.3
Yes	4283	16.7

Chronic Lung Diseases (CLDs).

4.1.1 Model 1: Main Effect Model

Table 2 shows a summary of the output of *Model 1*. In this model, educational attainment and income (poverty status) were the independent variables and any CLD was the dependent variable. This model was estimated in the total sample which included Whites, Blacks, Hispanics, and non-Hispanics. *Model 1* only entered the main effects of SES indicators (educational attainment and income [poverty status]) as well as race, ethnicity, and covariates. Based on *Model 1*, high educational attainment and high income (living out of poverty) were associated with lower odds of CLDs (Table 2).

Table 2. Logistic Regression in the Pooled Sample (Model 1; Main Effects)

	B	SE	OR	95% CI	p
Race (Black)	-0.12	0.05	0.89	0.81 0.97	.012
Ethnicity (Hispanic)	-0.42	0.05	0.66	0.59 0.73	.000
Age					.000
18 - 24			1.00		
25 - 34	0.01	0.05	1.01	0.91 1.12	.829
35 - 44	0.14	0.06	1.14	1.02 1.28	.017
45 - 54	0.23	0.06	1.26	1.13 1.40	.000
55 - 64	0.44	0.06	1.55	1.39 1.73	.000
65 - 74	0.44	0.07	1.56	1.36 1.79	.000
75+ years old	0.23	0.10	1.25	1.03 1.53	.026
Region					.017
Northeast			1.00		
Midwest	-0.09	0.05	0.91	0.82 1.02	.093
South	-0.16	0.05	0.85	0.77 0.94	.002
West	-0.08	0.06	0.92	0.82 1.03	.148
Employment (Full)	-0.42	0.04	0.66	0.61 0.71	.000
Educational Attainment					

Less than High School Graduate			1.00			
High School Graduate	-0.11	0.04	0.90	0.82	0.98	.015
College Graduate	-0.22	0.05	0.80	0.73	0.88	.000
Income Level (Living Out of Poverty)	-0.23	0.04	0.80	0.73	0.86	.000
Constant	-1.13	0.07	0.32			.000

Note. Source Population Assessment of Tobacco and Health (PATH; 2013-2014).

CI: Confidence Interval; SE: Standard Error; OR: Odds Ratio.

Outcome: Chronic Lung Diseases (CLDs).

4.1.2 Model 2: Interaction Model

Table 3 shows a summary of the output of Model 2. This model was estimated in the total sample which included Whites, Blacks, Hispanics, and non-Hispanics. Different from *Model 1* which only entered the main effects of SES indicators and race, ethnicity, and covariates, *Model 2*, also added four interaction terms between race and ethnicity with educational attainment and income (poverty status). *Model 2* showed significant interactions between race and ethnicity with educational attainment and income (poverty status), suggesting that high educational attainment and high income (living out of poverty) have smaller protective effects against CLDs for Blacks and Hispanics than Whites (Table 3).

Table 3. Logistic Regression in the Pooled Sample (Mode 2: Interaction Model)

	B	SE	OR	95% CI		p
Race (Black)	-0.33	0.10	0.72	0.60	0.87	.001
Ethnicity (Hispanic)	-0.89	0.10	0.41	0.33	0.50	.000
Age						.000
18 - 24			1.00			
25 - 34	0.01	0.05	1.01	0.91	1.12	.839
35 - 44	0.14	0.06	1.15	1.03	1.29	.012
45 - 54	0.24	0.06	1.27	1.14	1.41	.000
55 - 64	0.46	0.06	1.58	1.41	1.76	.000
65 - 74	0.47	0.07	1.60	1.39	1.83	.000
75+ years old	0.26	0.10	1.29	1.06	1.58	.012
Region						.007
Northeast			1.00			
Midwest	-0.10	0.05	0.91	0.82	1.01	.073
South	-0.17	0.05	0.84	0.76	0.93	.001
West	-0.09	0.06	0.92	0.82	1.03	.131
Employment (Full)	-0.41	0.04	0.66	0.61	0.71	.000

Educational Attainment						
Less than High School Graduate						1.00
High School Graduate	-0.21	0.05	0.81	0.73	0.90	.000
College Graduate	-0.22	0.05	0.80	0.73	0.89	.000
Income Level (Living Out of Poverty)	-0.32	0.05	0.72	0.66	0.80	.000
Race (Black) x High School Graduate	0.14	0.11	1.14	0.92	1.42	.214
Race (Black) x College Graduate	-0.07	0.15	0.93	0.69	1.26	.647
Ethnicity (Hispanic) x High School Graduate	0.42	0.12	1.52	1.20	1.92	.000
Ethnicity (Hispanic) x College Graduate	0.25	0.16	1.29	0.94	1.77	.120
Race (Black) x Living Out of Poverty	0.21	0.10	1.23	1.02	1.49	.030
Ethnicity (Hispanic) x Living Out of Poverty	0.31	0.11	1.37	1.11	1.69	.004
Constant	-0.98	0.07	0.37			.000

Note. Source Population Assessment of Tobacco and Health (PATH; 2013-2014).

CI: Confidence Interval; SE: Standard Error; OR: Odds Ratio.

Outcome: Chronic Lung Diseases (CLDs).

5. Discussion

Two findings were observed. First, high educational attainment and income (poverty status) were inversely associated with the prevalence of CLDs in the overall sample. Second, Blacks and Hispanics were in a relative disadvantage in comparison to Whites regarding the protective effects of educational attainment and income levels on CLDs. That is, the negative associations between SES indicators (i.e., educational attainment and income level) and CLDs were weaker for Blacks and Hispanics than non-Hispanic Whites. As a result, highly educated and high-income Blacks and Hispanics remain at high risk of CLDs, compared to highly educated and high-income non-Hispanic Whites.

The 1st finding on the inverse association between SES indicators (i.e., educational attainment and income level) and CLDs is in line with what is known about the protective effects of SES on health overall (Mirowsky & Ross, 2015; Ross & Mirowsky, 1999) and CLDs (Assari & Moghani Lankarani, 2018; Kanervisto, Vasankari, Laitinen, Heliovaara, Jousilahti, & Saarelainen, 2011; Forno & Celedon, 2009) in particular. The protective health effects of SES indicators such as educational attainment and income are well documented across domains. Social gradient (Marmot, 2001), social determinants (Marmot, 2005; Marmot, 2004), fundamental cause (Phelan, Link, Diez-Roux, Kawachi, & Levin, 2004; Link & Phelan, 1995), and other related frameworks all suggest that health declines as social status (i.e., SES) declines.

The second observation, that the very same SES indicators (educational attainment and income levels) show considerably weaker effects on CLDs for Blacks and Hispanics than non-Hispanic Whites, is relatively new. Previously, for Blacks, high income and educational attainment were shown to have weaker effects on asthma (Assari & Moghani Lankarani, 2018) and COPD (Assari, Caldwell, &

Bazargan, 2019). However, this was never shown for Hispanic people. It was also not shown for CLDs overall.

The results may be due to the fact that highly educated and high-income Blacks and Hispanics smoke cigarette (Assari & Mistry, 2018; 2019) and vape e-cigarette (Assari, Mistry, & Bazargan, 2020) more than what is expected based on their SES. Such more than expected behavioral risk profile of high-SES Blacks and Hispanics is not limited to tobacco use as similar patterns are seen for alcohol use (Assari, Farokhnia, & Mistry, 2019), diet (Assari & Lankarani, 2018), exercise (Assari, 2019), impulse control (Assari, Caldwell, & Mincy, 2018), suicide (Assari, Schatten, Arias, Miller, Camargo, & Boudreaux, 2019), depression (Assari, 2018; Assari, 2017; Assari, Gibbons, & Simons, 2018; Assari, 2018; Assari & Caldwell, 2018), anxiety (Assari, Caldwell, & Zimmerman, 2018), stress (Assari, Lankarani, & Caldwell, 2018; Assari, 2018), and obesity (Assari, Thomas, Caldwell, & Mincy, 2018). These patterns are shown inside clinics (Assari, Schatten, Arias, Miller, Camargo, & Boudreaux, 2019) and in communities (Assari, Caldwell, & Zimmerman, 2018; Assari, Lapeyrouse, & Neighbors, 2018), as well as within (Assari, 2018) and between (Assari, Caldwell, & Mincy, 2018) generations. They are also shown for children (Assari & Moghani Lankarani, 2018), youth (Assari, Caldwell, & Zimmerman, 2018), adults (Assari, 2018), and older adults (Assari & Bazargan, 2019). The universal nature of these diminished returns is suggestive of structural factors that reduce the health effects of SES for all marginalized people. Some may call these forces structural racism and social stratification.

5.1 Limitations

The major limitation of this study is its cross-sectional design. As a result of such design, we do not infer causal effects from our observations. As SES and health have bidirectional associations, reverse causal effect of health on SES cannot be ruled out. Poor health is one of the reasons behind downward social mobility. This study measured CLDs such as COPD and asthma based on self-report rather than physical examination, laboratory testing, or administered data (e.g., insurance claims). Self-reports have been shown to generate valid and reliable measures of chronic diseases (Martin, Leff, Calonge, Garrett, & Nelson, 2000). However, future research may replicate these findings for other ethnic groups, as well as based on immigration status. Future research may also use comprehensive multi-item measures. The study is probably biased by omitted confounders such as wealth and area SES. We did not control for smoking because smoking may be the reason high SES Blacks and Hispanics are at an increased risk of CLDs. Thus, the study did not control for the intermediate / mediator variable. Still, this study had a large sample size and extends what we know regarding the non-linear effects of race, ethnicity, and SES on health outcomes particularly CLDs.

6. Conclusions

In the United States, the inverse associations between SES indicators (i.e., educational attainment and income) and CLDs are weaker for Blacks and Hispanics than non-Hispanic Whites. As a result, we observe a higher than expected prevalence of CLDs in highly educated and high-income Black and

Hispanic people, a rate which is disproportionate to their SES. Researchers should know that health disparities are not merely due to the additive but also multiplicative effects of race, ethnicity and SES. Real solution to racial and health disparities in CLDs is not only increasing SES of Blacks and Hispanic but also empowering them to translate their available SES resources to health outcomes. Public policies that are needed should go beyond equalizing SES and specifically address societal barriers, environmental risk factors, and structural factors that endanger the health and well-being of Blacks and Hispanics at all SES levels. Economic and public policies are needed to minimize diminished health returns of SES (i.e., MDRs) for racial and ethnic minorities. Unfortunately, contribution of MDRs to racial and ethnic health disparities are historically overlooked in the U.S.

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